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Jan 2, 2003

DOCUMENT-IDENTIFIER: US 20030004063 A1

TITLE: Coformulation of an oil-soluble herbicide and a water-soluble herbicide

Summary of Invention Paragraph (13):

[0011] Briefly, therefore, the present invention is directed to a liquid concentrate herbicidal emulsion composition comprising a water-soluble herbicide in water and an oil-soluble herbicide. The water-soluble herbicide and the oil-soluble herbicide are independently present in a concentration that is biologically effective when the composition is diluted in a suitable volume of water and applied to the foliage of a susceptible plant. The composition further comprises a stabilizing amount of one or more water-soluble chlorides selected from hydrochloric acid, alkali metal chlorides, ammonium chloride, low molecular weight organic ammonium chlorides and quaternary ammonium chloride surfactants sufficient to inhibit substantial degradation of the oil-soluble herbicide; and one or more surfactants present in a concentration sufficient to provide acceptable physical stability of the emulsion and provide acceptable dispersion of the emulsion upon dilution thereof in a suitable volume of water for application to plants. The composition is further characterized in that the oil-soluble herbicide is selected from the group consisting of acetochlor, alachlor, ametryn, amidosulfuron, anilofos, atrazine, azafenidin, azimsulfuron, benfluralin, benfuresate, bensulfuron-methyl, bensulide, benzfendazole, benzofenap, bromobutide, bromofenoxim, butachlor, butafenacil, butamifos, butralin, butylate, cafenstrole, carbetamide, chlorbromuron, chloridazon, chlorimuron-ethyl, chlorotoluron, chlorpropham, chloresulfuron, chlorthal-dimethyl, chlorthiamid, cinidon-ethyl, cinnemethylin, cinosulfuron, clomazone, clomeprop, cloransulam-methyl, cyanazine, cycloate, cyclosulfamuron, daimuron, desmedipham, desmetryn, dichlobenil, diflufenican, dimefuron, dimepiperate, dimethachlor, dimethametryn, dimethenamid, dinitramine, dinoterb, diphenamid, dithiopyr, diuron, EPTC, esprocarb, ethalfluralin, ethametsulfuron-methyl, ethofumesate, ethoxysulfuron, etobenzanid, fenoxaprop-ethyl, fenuron, flamprop-methyl, flazasulfuron, flazolate, fluchloralin, flumetsulam, flumiclorac-pentyl, flumioxazin, fluometuron, fluorchloridone, flupoxam, flurenol, fluridone, fluroxypyr-1-methylheptyl, flurtamone, fluthiacet-methyl, halosulfuron, hexazinone, imazosulfuron, indanofan, isoproturon, isouron, isoxaben, isoxaflutole, lenacil, linuron, mefenacet, metamitron, metazachlor, methabenzthiazuron, methyldymron, metobenzuron, metobromuron, metolachlor, metosulam, metoxuron, metribuzin, metsulfuron, molinate, monolinuron, naproanilide, napropamide, neburon, nicosulfuron, norflurazon, orbencarb, oryzalin, oxadiargyl, oxadiazon, oxasulfuron, pebulate, pendimethalin, pentanochlor, pentoxazone, phenmedipham, piperophos, pretilachlor, primisulfuron, prodiamine, proflumazone, prometon, prometryn, propachlor, propanil, propazine, propham, propisochlor, propyzamide, prosulfocarb, prosulfuron, pyraflufen-ethyl, pyrazogyl, pyrazolynate, pyrazosulfuron-ethyl, pyrazoxyfen, pyributicarb, pyridate, pyriminobac-methyl, quinclorac, quinmerac, rimsulfuron, siduron, simazine, simetryn, sulcotrione, sulfentrazone, sulfometuron, sulfosulfuron, tebutam, tebuthiuron, terbacil, terbutometon, terbuthylazine, terbutryn, thenylchlor, thiazopyr, thidiazimin, thifensulfuron, thiobencarb, tiocarbazil, triallate, triasulfuron, tribenuron, trietazine, trifluralin, triflurosulfuron and vernolate.

Summary of Invention Paragraph (14):

[0012] The present invention is further directed to a liquid concentrate herbicidal emulsion composition comprising a water-soluble herbicide in water and an oil-soluble herbicide. The water-soluble herbicide and the oil-soluble herbicide are

Summary of Invention Paragraph (15):

[0013] The present invention is further directed to a liquid concentrate herbicidal microemulsion composition having a continuous aqueous phase and a discontinuous oil phase. The composition comprises a water-soluble herbicide in the aqueous phase present in a concentration that is biologically effective when the composition is diluted in a suitable volume of water and applied to the foliage of a susceptible plant. The composition further comprises an oil-soluble herbicide in the oil phase present in a concentration that is biologically effective when the composition is diluted in a suitable volume of water and applied to the foliage of a susceptible plant; and at least one emulsifying agent having a tertiary amine functionality wherein the emulsifying agent is present in a concentration sufficient to provide acceptable physical stability of the microemulsion. The composition is further characterized in that the oil-soluble herbicide is selected from the group consisting of acetochlor, alachlor, ametryn, amidosulfuron, anilofos, atrazine, azafenidin, azimsulfuron, benfluralin, benfuresate, bensulfuron-methyl, bensulide, benzfendizone, benzofenap, bromobutide, bromofenoxim, butachlor, butafenacil, butamifos, butralin, butylate, cafenstrole, carbetamide, chlorbromuron, chloridazon, chlorimuron-ethyl, chlorotoluron, chlorpropham, chlorsulfuron, chlorthal-dimethyl, chlorthiamid, cinidon-ethyl, cinmethylin, cinosulfuron, clomazone, clomeprop, cloransulam-methyl, cyanazine, cycloate, cyclosulfamuron, daimuron, desmedipham, desmetryn, dichlobenil, diflufenican, dimefuron, dimepiperate, dimethachlor, dimethametryn, dimethenamid, dinitramine, dinoterb, diphenamid, dithiopyr, diuron, EPTC, esprocarb, ethalfluralin, ethametsulfuron-methyl, ethofumesate, ethoxysulfuron, etobenzanid, fenoxaprop-ethyl, fenuron, flumprop-methyl, flazasulfuron, fluazolate, fluchloralin, flumetsulam, flumiclorac-pentyl, flumioxazin, fluometuron, fluorochloridone, flupoxam, flurenol, fluridone,

fluroxypyr-1-methylheptyl, flurtamone, fluthiacet-methyl, halosulfuron, hexazinone, imazosulfuron, indanofan, isoproturon, isouron, isoxaben, isoxaflutole, lenacil, linuron, mefenacet, metamitron, metazachlor, methabenzthiazuron, methyldymron, metobenzuron, metobromuron, metolachlor, metosulam, metoxuron, metribuzin, metsulfuron, molinate, monolinuron, naproanilide, napropamide, neburon, nicosulfuron, norflurazon, orbencarb, oryzalin, oxadiargyl, oxadiazon, oxasulfuron, pebulate, pendimethalin, pentanochlor, pentoxazone, phenmedipham, piperophos, pretilachlor, primisulfuron, prodiamine, profluzol, prometon, prometryn, propachlor, propanil, propazine, propham, propisochlor, propyzamide, prosulfocarb, prosulfuron, pyraflufen-ethyl, pyrazogyl, pyrazolynate, pyrazosulfuron-ethyl, pyrazoxyfen, pyributicarb, pyridate, pyriminobac-methyl, quinclorac, quinmerac, rimsulfuron, siduron, simazine, simetryn, sulcotrione, sulfentrazone, sulfometuron, sulfosulfuron, tebutam, tebuthiuron, terbacil, terbumeton, terbuthylazine, terbutryn, thenylchlor, thiazopyr, thidiazimin, thifensulfuron, thiobencarb, tiocarbazil, triallate, triasulfuron, tribenuron, trietazine, trifluralin, triflusulfuron and vernolate.

#### Summary of Invention Paragraph (16):

[0014] The present invention is still further directed to a liquid concentrate herbicidal microemulsion composition having a continuous aqueous phase and a discontinuous oil phase. The composition comprises a water-soluble herbicide in the aqueous phase and an oil-soluble herbicide in the oil phase. The water-soluble herbicide and the oil-soluble herbicide are independently present in a concentration that is biologically effective when the composition is diluted in a suitable volume of water and applied to the foliage of a susceptible plant. The composition further comprises a stabilizing amount of one or more water-soluble chlorides selected from hydrochloric acid, alkali metal chlorides, ammonium chloride, low molecular weight organic ammonium chlorides and quaternary ammonium chloride surfactants; and one or more surfactants present in a concentration sufficient to provide acceptable physical stability of the emulsion and provide acceptable dispersion of the emulsion upon dilution thereof in a suitable volume of water for application to plants. The composition is further characterized in that the oil-soluble herbicide is selected from the group consisting of acetochlor, alachlor, ametryn, amidosulfuron, anilofos, atrazine, azafenidin, azimsulfuron, benfluralin, benfuresate, bensulfuron-methyl, bensulide, benzfendizone, benzofenap, bromobutide, bromofenoxim, butachlor, butafenacil, butamifos, butralin, butylate, cafenstrole, carbetamide, chlorbromuron, chloridazon, chlorimuron-ethyl, chlorotoluron, chlorpropham, chlorsulfuron, chlorthal-dimethyl, chlorthiamid, cinidon-ethyl, cinmethylin, cinosulfuron, clomazone, clomeprop, cloransulam-methyl, cyanazine, cycloate, cyclosulfamuron, daimuron, desmedipham, desmetryn, dichlobenil, diflufenican, dimefuron, dimepiperate, dimethachlor, dimethametryn, dimethenamid, dinitramine, dinoterb, diphenamid, dithiopyr, diuron, EPTC, esprocarb, ethalfluralin, ethametsulfuron-methyl, ethofumesate, ethoxysulfuron, etobenzanid, fenoxaprop-ethyl, fenuron, flamprop-methyl, flazasulfuron, fluazolate, fluchloralin, flumetsulam, flumiclorac-pentyl, flumioxazin, fluometuron, fluorchloridone, flupoxam, flurenol, fluridone, fluroxypyr-1-methylheptyl, flurtamone, fluthiacet-methyl, halosulfuron, hexazinone, imazosulfuron, indanofan, isoproturon, isouron, isoxaben, isoxaflutole, lenacil, linuron, mefenacet, metamitron, metazachlor, methabenzthiazuron, methyldymron, metobenzuron, metobromuron, metolachlor, metosulam, metoxuron, metribuzin, metsulfuron, molinate, monolinuron, naproanilide, napropamide, neburon, nicosulfuron, norflurazon, orbencarb, oryzalin, oxadiargyl, oxadiazon, oxasulfuron, pebulate, pendimethalin, pentanochlor, pentoxazone, phenmedipham, piperophos, pretilachlor, primisulfuron, prodiamine, profluzol, prometon, prometryn, propachlor, propanil, propazine, propham, propisochlor, propyzamide, prosulfocarb, prosulfuron, pyraflufen-ethyl, pyrazogyl, pyrazolynate, pyrazosulfuron-ethyl, pyrazoxyfen, pyributicarb, pyridate, pyriminobac-methyl, quinclorac, quinmerac, rimsulfuron, siduron, simazine, simetryn, sulcotrione, sulfentrazone, sulfometuron, sulfosulfuron, tebutam, tebuthiuron, terbacil, terbumeton, terbuthylazine, terbutryn, thenylchlor, thiazopyr, thidiazimin, thifensulfuron, thiobencarb, tiocarbazil, triallate, triasulfuron, tribenuron, trietazine, trifluralin, triflusulfuron and vernolate.

#### Summary of Invention Paragraph (17):

[0015] Still further, the present invention is directed to a liquid concentrate herbicidal microemulsion composition having a continuous aqueous phase and a

Summary of Invention Paragraph (18):

[0016] Still further, the present invention is directed to a liquid concentrate herbicidal microemulsion composition. The composition comprises a continuous aqueous phase comprising N-(phosphonomethyl)glycine or a salt thereof and a discontinuous oil phase comprising an oil-soluble protoporphyrinogen oxidase inhibitor (PPO) herbicide. The N-(phosphonomethyl)glycine and the PPO herbicide are independently present in a concentration that is biologically effective when the composition is diluted in a suitable volume of water and applied to the foliage of a susceptible plant. The composition further comprises a substantially water-immiscible organic solvent in the oil phase; at least one emulsifying agent having a tertiary amine functionality; a stabilizing agent present in a concentration sufficient to inhibit substantial degradation of the PPO herbicide; and one or more dispersing agents present in a concentration sufficient to provide acceptable dispersion of the microemulsion upon dilution thereof in a suitable volume of water for application to plants, but not sufficient to destabilize the microemulsion prior to such dilution. The composition is further characterized in that the organic solvent is selected such that the oil-soluble herbicide has an organic solvent/water partition coefficient, expressed as a logarithm, of about 4 or greater; the emulsifying agent

is present in a concentration sufficient to provide acceptable physical stability of the microemulsion; and the PPO herbicide is selected from the group consisting of azafenidin, benzfendizone, butafenacil, cinidon-ethyl, fluazolate, flumiclorac-pentyl, flumioxazin, fluthiacet-methyl, oxadiargyl, oxadiazon, pentoxazone, profluzol, pyraflufen-ethyl, pyrazogyl, sulfentrazone and thidiazimin.

Summary of Invention Paragraph (34):

[0031] The oil phase of a composition of the present invention comprises a solvent having an oil-soluble herbicidal active ingredient dissolved therein. Oil-soluble herbicides suitable for use in compositions of the present invention include but are not limited to acetochlor, aclonifen, alachlor, ametryn, amidosulfuron, anilofos, atrazine, azafenidin, azimsulfuron, benfluralin, benfuresate, bensulfuron-methyl, bensulide, benzfendizone, benzofenap, bifenox, bromobutide, bromofenoxim, butachlor, butafenacil, butamifos, butralin, butroxydim, butylate, cafenstrole, carfentrazone-ethyl, carbetamide, chlomethoxyfen, chlorbromuron, chloridazon, chlorimuron-ethyl, chlorotoluron, chlornitrofen, chlorotoluron, chlorpropham, chlorsulfuron, chlorthal-dimethyl, chlorthiamid, cinidon-ethyl, cinmethylin, cinosulfuron, clethodim, clodinafop-propargyl, clomazone, clomeprop, cloransulam-methyl, cyanazine, cycloate, cyclosulfamuron, cycloxydim, cyhalofop-butyl, daimuron, desmedipham, desmetryn, dichlobenil, diclofop-methyl, diflufenican, dimefuron, dimepiperate, dimethachlor, dimethametryn, dimethenamid, dinitramine, dinoterb, diphenamid, dithiopyr, diuron, EPTC, esprocarb, ethalfluralin, ethametsulfuron-methyl, ethofumesate, ethoxysulfuron, etobenzanid, fenoxaprop-ethyl, fenuron, flamprop-methyl, flazasulfuron, fluazifop-butyl, fluazifop-P-butyl, fluazolate, fluchloralin, flumetsulam, flumiclorac-pentyl, flumioxazin, fluometuron, fluorchloridone, fluoroglyphofen-ethyl, flupoxam, flurenol, fluridone, fluroxypyr-1-methylheptyl, flurtamone, fluthiacet-methyl, fomesafen, graminicides, halosafen, halosulfuron, haloxyfop, hexazinone, imazosulfuron, indanofan, isoproturon, isouron, isoxaben, isoxaflutole, isoxapyrifop, lactofen, lenacil, linuron, mefenacet, metamitron, metazachlor, methabenzthiazuron, methylcymron, metobenzuron, metobromuron, metolachlor, metosulam, metoxuron, metribuzin, metsulfuron, molinate, monolinuron, naproanilide, napropamide, neburon, nicosulfuron, norflurazon, orbencarb, oryzalin, oxadiargyl, oxadiazon, oxasulfuron, oxyfluorfen, pebulate, pendimethalin, pentanochlor, pentoxazone, phenmedipham, piperophos, pretilachlor, primisulfuron, prodiamine, profluzol, prometon, prometryn, propachlor, propanil, propaquizafop, propazine, propham, propisochlor, propyzamide, prosulfocarb, prosulfuron, pyraflufen-ethyl, pyrazogyl, pyrazolynate, pyrazosulfuron-ethyl, pyrazoxyfen, pyributicarb, pyridate, pyriminobac-methyl, quinclorac, quinmerac, quizalofop, quizalofop-P, rimsulfuron, sethoxydim, siduron, simazine, simetryn, sulcotrione, sulfentrazone, sulfometuron, sulfosulfuron, tebutam, tebuthiuron, tepraloxydim, terbacil, terbumeton, terbuthylazine, terbutryn, thenylchlor, thiazopyr, thidiazimin, thifensulfuron, thiobencarb, tiocarbazil, tralkoxydim, triallate, triasulfuron, tribenuron, trietazine, trifluralin, triflusulfuron and vernolate.

Summary of Invention Paragraph (35):

[0032] Preferred oil-soluble herbicides for use in a composition of the invention include but are not limited to acetochlor, aclonifen, alachlor, ametryn, amidosulfuron, anilofos, atrazine, azafenidin, azimsulfuron, benfluralin, benfuresate, bensulfuron-methyl, bensulide, benzfendizone, benzofenap, bromobutide, bromofenoxim, butachlor, butafenacil, butamifos, butralin, butroxydim, butylate, cafenstrole, carfentrazone-ethyl, carbetamide, chlorbromuron, chloridazon, chlorimuron-ethyl, chlorotoluron, chlornitrofen, chlorotoluron, chlorpropham, chlorsulfuron, chlorthal-dimethyl, chlorthiamid, cinidon-ethyl, cinmethylin, cinosulfuron, clethodim, clodinafop-propargyl, clomazone, clomeprop, cloransulam-methyl, cyanazine, cycloate, cyclosulfamuron, cycloxydim, cyhalofop-butyl, daimuron, desmedipham, desmetryn, dichlobenil, diclofop-methyl, diflufenican, dimefuron, dimepiperate, dimethachlor, dimethametryn, dimethenamid, dinitramine, dinoterb, diphenamid, dithiopyr, diuron, EPTC, esprocarb, ethalfluralin, ethametsulfuron-methyl, ethofumesate, ethoxysulfuron, etobenzanid, fenoxaprop-ethyl, fenuron, flamprop-methyl, flazasulfuron, fluazifop-butyl, fluazifop-P-butyl, fluazolate, fluchloralin, flumetsulam, flumiclorac-pentyl, flumioxazin, fluometuron, fluorchloridone, flupoxam, flurenol, fluridone, fluroxypyr-1-methylheptyl-1, flurtamone, fluthiacet-methyl, graminicides,

halosulfuron, haloxyfop, hexazinone, imazosulfuron, indanofan, isoproturon, isouron, isoxaben, isoxaflutole, isoxapyrifop, lenacil, linuron, mefenacet, metamitron, metazachlor, methabenzthiazuron, methyldymron, metobenzuron, metobromuron, metolachlor, metosulam, metoxuron, metribuzin, metsulfuron, molinate, monolinuron, naproanilide, napropamide, neburon, nicosulfuron, norflurazon, orbencarb, oryzalin, oxadiargyl, oxadiazon, oxasulfuron, pebulate, pendimethalin, pentanochlor, pentoxazone, phenmedipham, piperophos, pretilachlor, primisulfuron, prodiamine, profluzol, prometon, prometryn, propachlor, propanil, propaquizafop, propazine, propham, propisochlor, propyzamide, prosulfocarb, prosulfuron, pyraflufen-ethyl, pyrazogyl, pyrazolynate, pyrazosulfuron-ethyl, pyrazoxyfen, pyributicarb, pyridate, pyriminobac-methyl, quinclorac, quimnerac, quizalofop, quizalofop-P, rimsulfuron, sethoxydim, siduron, simazine, simetryn, sulcotrione, sulfentrazone, sulfometuron, sulfosulfuron, tebutam, tebuthiuron, tepraloxydim, terbacil, terbumeton, terbuthylazine, terbutryn, thenylchlor, thiazopyr, thidiazimin, thifensulfuron, thiobencarb, tiocarbazil, tralkoxydim, triallate, triasulfuron, tribenuron, trietazine, trifluralin, triflusulfuron and vernolate.

Summary of Invention Paragraph (36):

[0033] Another class of preferred oil-soluble herbicides for use in a composition of the invention are protoporphyrinogen oxidase inhibitor (PPO) herbicides. PPO herbicides are known to affect plants by inhibiting protoporphyrinogen oxidase in chloroplasts, thereby disrupting photosynthesis and other biological processes and causing early symptoms of tissue necrosis in plants. General classes of PPO herbicides include diphenylether herbicides (e.g., bifenox, chlomethoxyfen, fluoroglycofen-ethyl, fomesafen, halosafen, lactofen and oxyfluorfen); phenylpyrazoles (e.g., fluazolate and pyraflufen-ethyl); N-phenylphthalimides (e.g., cinidon-ethyl, flumioxazin and flumiclorac-pentyl); thiadiazoles (e.g., fluthiacet-methyl and thidiazimin); oxadiazoles (e.g., oxadiazon and oxadiargyl); triazolinones (e.g., azafenidin, carfentrazone-ethyl and sulfentrazone); oxazolidinediones (e.g., pentoxazone); pyrimidindiones (e.g., benzfendizone and butafencil); pyrazogyl and profluzol.

Summary of Invention Paragraph (37):

[0034] A particularly preferred class of PPO herbicides are the triazolinones. Triazolinone herbicides are known to provide good control of broadleaf weeds but are less efficacious in controlling grasses. Suitable triazolinone herbicides for use in compositions of the invention are described generally in U.S. Pat. Nos. 5,217,520 and 5,125,958 to Poss and U.S. Pat. No. 4,818,275 to Theodoridis, all of which are hereby incorporated herein by reference. A triazolinone herbicide suitable for use in a composition of the invention can be a compound of the structure shown in the following formula: 1

Summary of Invention Paragraph (41):

[0038] In a composition of the invention, the herbicidal active ingredients are generally present in an amount which is biologically effective when the composition is diluted in a suitable volume of water and applied to the foliage of a susceptible plant. Typically, the oil-soluble herbicide is present in a concentration such that the weight ratio of water-soluble herbicide to oil-soluble herbicide ranges from about 190:1 to about 1:1. For example, when the oil-soluble herbicide is a PPO herbicide such as a triazolinone, the weight ratio of triazolinone to water-soluble herbicide ranges from about 190:1 to about 19:1. In any case, the concentration of the oil-soluble herbicide in the composition as a whole is about 0.1% to about 25% by weight. In preferred compositions, the concentration of the oil-soluble herbicide is about 0.1% to about 5% by weight, for example about 0.2% to about 2%, by weight.

Summary of Invention Paragraph (71):

[0068] In a particularly preferred composition of the invention, the oil-soluble herbicide is carfentrazone-ethyl, a PPO herbicide of the triazolinone class, and the water-soluble herbicide is a salt of N-(phosphonomethyl)glycine ("glyphosate").

**CLAIMS:**

1. A liquid concentrate herbicidal emulsion composition comprising: (i) a water-soluble herbicide in water, the water-soluble herbicide being present in a concentration that is biologically effective when the composition is diluted in a

suitable volume of water and applied to the foliage of a susceptible plant; (ii) an oil-soluble herbicide present in a concentration that is biologically effective when the composition is diluted in a suitable volume of water and applied to the foliage of a susceptible plant; (iii) a stabilizing amount of one or more water-soluble chlorides selected from hydrochloric acid, alkali metal chlorides, ammonium chloride, low molecular weight organic ammonium chlorides and quaternary ammonium chloride surfactants sufficient to inhibit substantial degradation of the oil-soluble herbicide; and (iv) one or more surfactants present in a concentration sufficient to provide acceptable physical stability of the emulsion and provide acceptable dispersion of the emulsion upon dilution thereof in a suitable volume of water for application to plants; wherein the oil-soluble herbicide is selected from the group consisting of acetochlor, alachlor, ametryn, amidosulfuron, anilofos, atrazine, azafenidin, azimsulfuron, benfluralin, benfuresate, bensulfuron-methyl, bensulide, benzfendizone, benzofenap, bromobutide, bromofenoxim, butachlor, butafenacil, butamifos, butralin, butylate, cafenstrole, carbetamide, chlorbromuron, chloridazon, chlorimuron-ethyl, chlorotoluron, chlorpropham, chlosulfuron, chlorthal-dimethyl, chlorthiamid, cinidon-ethyl, cinmethylin, cinosulfuron, clomazone, clomeprop, cloransulam-methyl, cyanazine, cycloate, cyclosulfamuron, daimuron, desmedipham, desmetryn, dichlobenil, diflufenican, dimefuron, dimepiperate, dimethachlor, dimethametryn, dimethenamid, dinitramine, dinoterb, diphenamid, dithiopyr, diuron, EPTC, esprocarb, ethalfluralin, ethametsulfuron-methyl, ethofumesate, ethoxysulfuron, etobenzanid, fenoxaprop-ethyl, fenuron, flamprom-methyl, flazasulfuron, fluazolate, fluchloralin, flumetsulam, flumiclorac-pentyl, flumioxazin, fluometuron, fluorchloridone, flupoxam, flurenol, fluridone, fluroxypyr-1-methylheptyl, flurtamone, fluthiacet-methyl, halosulfuron, hexazinone, imazosulfuron, indanofan, isoproturon, isouron, isoxaben, isoxaflutole, lenacil, linuron, mefenacet, metamitron, metazachlor, methabenzthiazuron, methyldymron, metobenzuron, metobromuron, metolachlor, metosulam, metoxuron, metribuzin, metsulfuron, molinate, monolinuron, naproanilide, napropamide, neburon, nicosulfuron, norflurazon, orbencarb, oryzalin, oxadiargyl, oxadiazon, oxasulfuron, pebulate, pendimethalin, pentanochlor, pentoxazone, phenmedipham, piperophos, pretilachlor, primisulfuron, prodiamine, profluazol, prometon, prometryn, propachlor, propanil, propazine, propham, propisochlor, propyzamide, prosulfocarb, prosulfuron, pyraflufen-ethyl, pyrazogyl, pyrazolynate, pyrazosulfuron-ethyl, pyrazoxyfen, pyributicarb, pyridate, pyriminobac-methyl, quinclorac, quinmerac, rimsulfuron, siduron, simazine, simetryn, sulcotrione, sulfentrazone, sulfometuron, sulfosulfuron, tebutam, tebuthiuron, terbacil, terbumeton, terbuthylazine, terbutryn, thenylchlor, thiazopyr, thidiazimin, thifensulfuron, thiobencarb, tiocarbazil, triallate, triasulfuron, tribenuron, trietazine, trifluralin, triflusulfuron and vernolate.

13. A composition as set forth in claim 1 wherein the oil-soluble herbicide comprises a protoporphyrinogen oxidase inhibitor (PPO) herbicide selected from the group consisting of azafenidin, benzfendizone, butafenacil, cinidon-ethyl, fluazolate, flumiclorac-pentyl, flumioxazin, fluthiacet-methyl, oxadiargyl, oxadiazon, pentoxazone, profluazol, pyraflufen-ethyl, pyrazogyl, sulfentrazone and thidiazimin.

28. A liquid concentrate herbicidal emulsion composition comprising: (i) a water-soluble herbicide in water, the water-soluble herbicide being present in a concentration that is biologically effective when the composition is diluted in a suitable volume of water and applied to the foliage of a susceptible plant; (ii) an oil-soluble herbicide present in a concentration that is biologically effective when the composition is diluted in a suitable volume of water and applied to the foliage of a susceptible plant; (iii) a substantially water-immiscible organic solvent; (iv) at least one emulsifying agent having a tertiary amine functionality; and (v) a stabilizing amount of one or more water-soluble chlorides selected from hydrochloric acid, alkali metal chlorides, ammonium chloride, low molecular weight organic ammonium chlorides and quaternary ammonium chloride surfactants sufficient to inhibit substantial degradation of the oil-soluble herbicide; wherein the oil-soluble herbicide is selected from the group consisting of acetochlor, alachlor, ametryn, amidosulfuron, anilofos, atrazine, azafenidin, azimsulfuron, benfluralin, benfuresate, bensulfuron-methyl, bensulide, benzfendizone, benzofenap, bromobutide, bromofenoxim, butachlor, butafenacil, butamifos, butralin, butylate, cafenstrole, carbetamide, chlorbromuron, chloridazon, chlorimuron-ethyl, chlorotoluron,



chlorpropham, chlorsulfuron, chlorthal-dimethyl, chlorthiamid, cinidon-ethyl, cinmethylin, cinosulfuron, clomazone, clomeprop, cloransulam-methyl, cyanazine, cycloate, cyclosulfamuron, daimuron, desmedipham, desmetryn, dichlobenil, diflufenican, dimefuron, dimepiperate, dimethachlor, dimethametryn, dimethenamid, dinitramine, dinoterb, diphenamid, dithiopyr, diuron, EPTC, esprocarb, ethalfluralin, ethametsulfuron-methyl, ethofumesate, ethoxysulfuron, etobenzanid, fenoxaprop-ethyl, fenuron, flamprop-methyl, flazasulfuron, fluazolate, fluchloralin, flumetsulam, flumiclorac-pentyl, flumioxazin, fluometuron, fluorchloridone, flupoxam, flurenol, fluridone, fluroxypyr-1-methylheptyl, flurtamone, fluthiacet-methyl, halosulfuron, hexazinone, imazosulfuron, indanofan, isoproturon, isouron, isoxaben, isoxaflutole, lenacil, linuron, mefenacet, metamiluron, metazachlor, methabenzthiazuron, methylidymron, metobenzuron, metobromuron, metolachlor, metosulam, metoxuron, metribuzin, metsulfuron, molinate, monolinuron, naproanilide, napropamide, neburon, nicosulfuron, norflurazon, orbencarb, oryzalin, oxadiargyl, oxadiazon, oxasulfuron, pebulate, pendimethalin, pentanochlor, pentoxazone, phenmedipham, piperophos, pretilachlor, primisulfuron, prodiamine, profluazol, prometon, prometryn, propachlor, propanil, propazine, propham, propisochlor, propyzamide, prosulfocarb, prosulfuron, pyraflufen-ethyl, pyrazogyl, pyrazolynate, pyrazosulfuron-ethyl, pyrazoxyfen, pyributicarb, pyridate, pyriminobac-methyl, quinclorac, quinmerac, rimsulfuron, siduron, simazine, simetryn, sulcotrione, sulfentrazone, sulfometuron, sulfosulfuron, tebutam, tebuthiuron, terbacil, terbumeton, terbuthylazine, terbutryn, thenylchlor, thiazopyr, thidiazimin, thifensulfuron, thiobencarb, tiocarbazil, triallate, triasulfuron, tribenuron, trietazine, trifluralin, triflusulfuron and vernolate.

40. A composition as set forth in claim 28 wherein the oil-soluble herbicide comprises a protoporphyrinogen oxidase inhibitor (PPO) herbicide selected from the group consisting of azafenidin, benzfendizone, butafenacil, cinidon-ethyl, fluazolate, flumiclorac-pentyl, flumioxazin, fluthiacet-methyl, oxadiargyl, oxadiazon, pentoxazone, profluazol, pyraflufen-ethyl, pyrazogyl, sulfentrazone and thidiazimin.

55. A liquid concentrate herbicidal microemulsion composition having a continuous aqueous phase and a discontinuous oil phase, the composition comprising: (i) a water-soluble herbicide in said aqueous phase, the water-soluble herbicide being present in a concentration that is biologically effective when the composition is diluted in a suitable volume of water and applied to the foliage of a susceptible plant; (ii) an oil-soluble herbicide in said oil phase, the oil-soluble herbicide being present in a concentration that is biologically effective when the composition is diluted in a suitable volume of water and applied to the foliage of a susceptible plant; and (iii) at least one emulsifying agent having a tertiary amine functionality, the emulsifying agent being present in a concentration sufficient to provide acceptable physical stability of the microemulsion; wherein the oil-soluble herbicide is selected from the group consisting of acetochlor, alachlor, ametryn, amidosulfuron, anilofos, atrazine, azafenidin, azimsulfuron, benfluralin, benfuresate, bensulfuron-methyl, bensulide, benzfendizone, benzofenap, bromobutide, bromofenoxim, butachlor, butafenacil, butamifos, butralin, butylate, cafenstrole, carbetamide, chlorbromuron, chloridazon, chlorimuron-ethyl, chlorotoluron, chlorpropham, chlorsulfuron, chlorthal-dimethyl, chlorthiamid, cinidon-ethyl, cinmethylin, cinosulfuron, clomazone, clomeprop, cloransulam-methyl, cyanazine, cycloate, cyclosulfamuron, daimuron, desmedipham, desmetryn, dichlobenil, diflufenican, dimefuron, dimepiperate, dimethachlor, dimethametryn, dimethenamid, dinitramine, dinoterb, diphenamid, dithiopyr, diuron, EPTC, esprocarb, ethalfluralin, ethametsulfuron-methyl, ethofumesate, ethoxysulfuron, etobenzanid, fenoxaprop-ethyl, fenuron, flamprop-methyl, flazasulfuron, fluazolate, fluchloralin, flumetsulam, flumiclorac-pentyl, flumioxazin, fluometuron, fluorchloridone, flupoxam, flurenol, fluridone, fluroxypyr-1-methylheptyl, flurtamone, fluthiacet-methyl, halosulfuron, hexazinone, imazosulfuron, indanofan, isoproturon, isouron, isoxaben, isoxaflutole, lenacil, linuron, mefenacet, metamiluron, metazachlor, methabenzthiazuron, methylidymron, metobenzuron, metobromuron, metolachlor, metosulam, metoxuron, metribuzin, metsulfuron, molinate, monolinuron, naproanilide, napropamide, neburon, nicosulfuron, norflurazon, orbencarb, oryzalin, oxadiargyl, oxadiazon, oxasulfuron, pebulate, pendimethalin, pentanochlor, pentoxazone, phenmedipham, piperophos, pretilachlor, primisulfuron, prodiamine, profluazol, prometon, prometryn, propachlor, propanil, propazine, propham,



propisochlor, propyzamide, prosulfocarb, prosulfuron, pyraflufen-ethyl, pyrazogyl, pyrazolynate, pyrazosulfuron-ethyl, pyrazoxyfen, pyributicarb, pyridate, pyriminobac-methyl, quinclorac, quinmerac, rimsulfuron, siduron, simazine, simetryn, sulcotrione, sulfentrazone, sulfometuron, sulfosulfuron, tebutam, tebuthiuron, terbacil, terbumeton, terbuthylazine, terbutryn, thenylchlor, thiazopyr, thidiazimin, thifensulfuron, thiobencarb, tiocarbazil, triallate, triasulfuron, tribenuron, trietazine, trifluralin, triflusulfuron and vernolate.

66. A composition as set forth in claim 55 wherein the oil-soluble herbicide comprises a protoporphyrinogen oxidase inhibitor (PPO) herbicide selected from the group consisting of azafenidin, benzfendizone, butafenacil, cinidon-ethyl, fluazolate, flumiclorac-pentyl, flumioxazin, fluthiacet-methyl, oxadiargyl, oxadiazon, pentoxazone, profluazol, pyraflufen-ethyl, pyrazogyl, sulfentrazone and thidiazimin.

85. A liquid concentrate herbicidal microemulsion composition having a continuous aqueous phase and a discontinuous oil phase, the composition comprising: (i) a water-soluble herbicide in said aqueous phase, the water-soluble herbicide being present in a concentration that is biologically effective when the composition is diluted in a suitable volume of water and applied to the foliage of a susceptible plant; (ii) an oil-soluble herbicide in said oil phase, the oil-soluble herbicide being present in a concentration that is biologically effective when the composition is diluted in a suitable volume of water and applied to the foliage of a susceptible plant; (iii) a stabilizing amount of one or more water-soluble chlorides selected from hydrochloric acid, alkali metal chlorides, ammonium chloride, low molecular weight organic ammonium chlorides and quaternary ammonium chloride surfactants; and (iv) one or more surfactants present in a concentration sufficient to provide acceptable physical stability of the emulsion and provide acceptable dispersion of the emulsion upon dilution thereof in a suitable volume of water for application to plants; wherein the oil-soluble herbicide is selected from the group consisting of acetochlor, alachlor, ametryn, amidosulfuron, anilofos, atrazine, azafenidin, azimsulfuron, benfluralin, benfuresate, bensulfuron-methyl, bensulide, benzfendizone, benzenofenap, bromobutide, bromofenoxim, butachlor, butafenacil, butamifos, butralin, butylate, cafenstrole, carbetamide, chlorbromuron, chloridazon, chlorimuron-ethyl, chlorotoluron, chlorpropham, chlorsulfuron, chlorthal-dimethyl, chlorthiamid, cinidon-ethyl, cinmethylin, cinosulfuron, clomazone, clomeprop, cloransulam-methyl, cyanazine, cycloate, cyclosulfamuron, daimuron, desmedipham, desmetryn, dichlobenil, diflufenican, dimefuron, dimepiperate, dimethachlor, dimethametryn, dimethenamid, dinitramine, dinoterb, diphenamid, dithiopyr, diuron, EPTC, esprocarb, ethalfluralin, ethametsulfuron-methyl, ethofumesate, ethoxysulfuron, etobenzanid, fenoxaprop-ethyl, fenuron, flamprop-methyl, flazasulfuron, fluazolate, fluchloralin, flumetsulam, flumiclorac-pentyl, flumioxazin, fluometuron, fluorchloridone, flupoxam, flurenol, fluridone, fluroxypyr-1-methylheptyl, flurtamone, fluthiacet-methyl, halosulfuron, hexazinone, imazosulfuron, indanofan, isoproturon, isouron, isoxaben, isoxaflutole, lenacil, linuron, mefenacet, metamitron, metazachlor, methabenzthiazuron, methylcymron, metobenzuron, metobromuron, metolachlor, metosulam, metoxuron, metribuzin, metsulfuron, molinate, monolinuron, naproanilide, napropamide, neburon, nicosulfuron, norflurazon, orbencarb, oryzalin, oxadiargyl, oxadiazon, oxasulfuron, pebulate, pendimethalin, pentanochlor, pentoxazone, phenmedipham, piperophos, pretilachlor, primisulfuron, prodiamine, profluazol, prometon, prometryn, propachlor, propanil, propazine, propham, propisochlor, propyzamide, prosulfocarb, prosulfuron, pyraflufen-ethyl, pyrazogyl, pyrazolynate, pyrazosulfuron-ethyl, pyrazoxyfen, pyributicarb, pyridate, pyriminobac-methyl, quinclorac, quinmerac, rimsulfuron, siduron, simazine, simetryn, sulcotrione, sulfentrazone, sulfometuron, sulfosulfuron, tebutam, tebuthiuron, terbacil, terbumeton, terbuthylazine, terbutryn, thenylchlor, thiazopyr, thidiazimin, thifensulfuron, thiobencarb, tiocarbazil, triallate, triasulfuron, tribenuron, trietazine, trifluralin, triflusulfuron and vernolate.

96. A composition as set forth in claim 85 wherein the oil-soluble herbicide comprises a protoporphyrinogen oxidase inhibitor (PPO) herbicide selected from the group consisting of azafenidin, benzfendizone, butafenacil, cinidon-ethyl, fluazolate, flumiclorac-pentyl, flumioxazin, fluthiacet-methyl, oxadiargyl, oxadiazon, pentoxazone, profluazol, pyraflufen-ethyl, pyrazogyl, sulfentrazone and

thidiazimin.

112. A liquid concentrate herbicidal microemulsion composition having a continuous aqueous phase and a discontinuous oil phase, the composition comprising: (i) a water-soluble herbicide in said aqueous phase, the water-soluble herbicide being present in a concentration that is biologically effective when the composition is diluted in a suitable volume of water and applied to the foliage of a susceptible plant; (ii) an oil-soluble herbicide in said oil phase, the oil-soluble herbicide being present in a concentration that is biologically effective when the composition is diluted in a suitable volume of water and applied to the foliage of a susceptible plant; (iii) a substantially water-immiscible organic solvent in said oil phase, wherein the organic solvent is selected such that the oil-soluble herbicide has an organic solvent/water partition coefficient, expressed as a logarithm, of about 4 or greater; (iv) at least one emulsifying agent having a tertiary amine functionality, the emulsifying agent being present in a concentration sufficient to provide acceptable physical stability of the microemulsion; (v) a stabilizing agent present in a concentration sufficient to inhibit substantial degradation of the oil-soluble herbicide; and (vi) one or more dispersing agents present in a concentration sufficient to provide acceptable dispersion of the microemulsion upon dilution thereof in a suitable volume of water for application to plants, but not sufficient to destabilize the microemulsion prior to such dilution; wherein the oil-soluble herbicide is selected from the group consisting of acetochlor, alachlor, ametryn, amidosulfuron, anilofos, atrazine, azafenidin, azimsulfuron, benfluralin, benfuresate, bensulfuron-methyl, bensulide, benzfendazole, benzofenap, bromobutide, bromofenoxim, butachlor, butafenacil, butamifos, butralin, butylate, cafenstrole, carbetamide, chlorbromuron, chloridazon, chlorimuron-ethyl, chlorotoluron, chlorpropham, chloresulfuron, chlorthal-dimethyl, chlorthiamid, cinidon-ethyl, cinmethylin, cinosulfuron, clomazone, clomeprop, cloransulam-methyl, cyanazine, cycloate, cyclosulfamuron, daimuron, desmedipham, desmetryn, dichlobenil, diflufenican, dimefuron, dimepiperate, dimethachlor, dimethametryn, dimethenamid, dinitramine, dinoterb, diphenamid, dithiopyr, diuron, EPTC, esprocarb, ethalfluralin, ethametsulfuron-methyl, ethofumesate, ethoxysulfuron, etobenzanid, fenoxaprop-ethyl, fenuron, flumetrop-methyl, flazasulfuron, fluzolate, fluchloralin, flumetsulam, flumiclorac-pentyl, flumioxazin, fluometuron, fluorchloridone, flupoxam, flurenol, fluridone, fluroxypyr-1-methylheptyl-1, flurtamone, fluthiacet-methyl, halosulfuron, hexazinone, imazosulfuron, indanofan, isoproturon, isouron, isoxaben, isoxaflutole, lenacil, linuron, mefenacet, metamitron, metazachlor, methabenzthiazuron, methylidymron, metobenzuron, metobromuron, metolachlor, metosulam, metoxuron, metribuzin, metsulfuron, molinate, monolinuron, naproanilide, napropamide, neburon, nicosulfuron, norflurazon, orbencarb, oryzalin, oxadiargyl, oxadiazon, oxasulfuron, pebulate, pendimethalin, pentanochlor, pentoxazone, phenmedipham, piperophos, pretilachlor, primisulfuron, prodiamine, profluazol, prometon, prometryn, propachlor, propanil, propazine, propham, propisochlor, propyzamide, prosulfocarb, prosulfuron, pyraflufen-ethyl, pyrazogyl, pyrazolynate, pyrazosulfuron-ethyl, pyrazoxyfen, pyributicarb, pyridate, pyriminobac-methyl, quinclorac, quinmerac, rimsulfuron, siduron, simazine, simetryn, sulcotrione, sulfentrazone, sulfometuron, sulfosulfuron, tebutam, tebuthiuron, terbacil, terbumeton, terbuthylazine, terbutryn, thenylchlor, thiazopyr, thidiazimin, thifensulfuron, thiobencarb, tiocarbazil, triallate, triasulfuron, tribenuron, trietazine, trifluralin, triflusulfuron and vernolate.

123. A composition as set forth in claim 112 wherein the oil-soluble herbicide comprises a protoporphyrinogen oxidase inhibitor (PPO) herbicide selected from the group consisting of azafenidin, benzfendazole, butafenacil, cinidon-ethyl, fluzolate, flumiclorac-pentyl, flumioxazin, fluthiacet-methyl, oxadiargyl, oxadiazon, pentoxazone, profluazol, pyraflufen-ethyl, pyrazogyl, sulfentrazone and thidiazimin.

139. A liquid concentrate herbicidal microemulsion composition comprising: (i) a continuous aqueous phase comprising N-(phosphonomethyl)glycine or a salt thereof, the N-(phosphonomethyl)glycine being present in a concentration that is biologically effective when the composition is diluted in a suitable volume of water and applied to the foliage of a susceptible plant; (ii) a discontinuous oil phase comprising an oil-soluble protoporphyrinogen oxidase inhibitor (PPO) herbicide, the PPO herbicide being present in a concentration that is biologically effective when the composition

is diluted in a suitable volume of water and applied to the foliage of a susceptible plant; (iii) a substantially water-immiscible organic solvent in said oil phase, wherein the organic solvent is selected such that the oil-soluble herbicide has an organic solvent/water partition coefficient, expressed as a logarithm, of about 4 or greater; (iv) at least one emulsifying agent having a tertiary amine functionality, the emulsifying agent being present in a concentration sufficient to provide acceptable physical stability of the microemulsion; (v) a stabilizing agent present in a concentration sufficient to inhibit substantial degradation of the PPO herbicide; and (vi) one or more dispersing agents present in a concentration sufficient to provide acceptable dispersion of the microemulsion upon dilution thereof in a suitable volume of water for application to plants, but not sufficient to destabilize the microemulsion prior to such dilution; wherein the PPO herbicide is selected from the group consisting of azafenidin, benzfendizone, butafenacil, cinidon-ethyl, fluazolate, flumiclorac-pentyl, flumioxazin, fluthiacet-methyl, oxadiargyl, oxadiazon, pentoxazone, profluzol, pyraflufen-ethyl, pyrazogyl, sulfentrazone and thidiazimin.

140. A composition as set forth in claim 139 wherein the combined concentration of N-(phosphonomethyl)glycine and the PPO herbicide ranges from about 5% to about 50% by weight of the composition.

141. A composition as set forth in claim 139 wherein the combined concentration of N-(phosphonomethyl)glycine and the PPO herbicide ranges from about 20% to about 50% by weight of the composition.

142. A composition as set forth in claim 139 wherein the weight ratio of N-(phosphonomethyl)glycine to PPO herbicide ranges from about 190:1 to about 1:1.

148. A composition as set forth in claim 139 wherein the weight ratio of organic solvent to PPO herbicide ranges from about 3:1 to about 75:1.

149. A composition as set forth in claim 139 wherein the weight ratio of organic solvent to PPO herbicide ranges from about 3:1 to about 60:1.

150. A composition as set forth in claim 139 wherein the weight ratio of organic solvent to PPO herbicide ranges from about 5:1 to about 50:1.

152. A composition as set forth in claim 139 wherein the organic solvent is selected such that the PPO herbicide has an organic solvent/water partition coefficient, expressed as a logarithm, of at least about 5 or greater.